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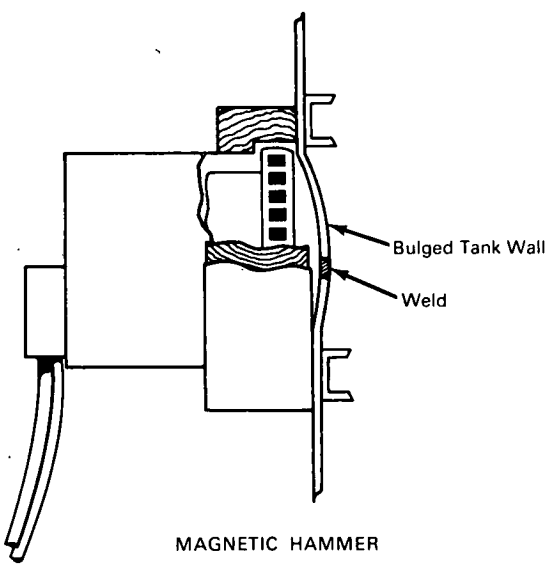
NASA TECH BRIEF

Electromagnetic Hammer Removes Weld Distortions from Aluminum Tanks



MAGNETIC HAMMER

The problem: To remove distortions (bulges) around the weld areas on sheet-aluminum tanks and other structures. Time-consuming hammer and die operations which have been commonly used for this purpose are not generally reliable and tend to damage the surface finish of the material.

The solution: A portable electromagnetic hammer incorporating a coil that generates a controlled high-energy pulsed magnetic field over localized areas on the metal surface. The magnetic field applies a fairly uniform force over an area corresponding to that of the face of the coil and thereby removes distortions (by bending or stretching of the metal) without the use of a die.

How it's done: The electromagnetic hammer includes five essential parts: a power source, capacitors for storing electric energy, transmission lines, a heavy-duty switching device (e.g., an ignitron), and a magnet coil consisting of a spirally wound insulated heavy conductor. The coil is mounted in a holder which is used to position the coil with respect to the work surface. The holder may also incorporate means for clamping it to the work surface and a pneumatic damping cylinder to absorb the recoil energy from the hammering operation.

The metal to be reshaped comprises part of the total magnetic system. When the electrical energy stored in the capacitor bank is switched into the magnet coil, the changing discharge current causes a changing magnetic field in the coil which induces surface currents in the workpiece. The magnetic field associated with the workpiece currents reacts with the magnetic field in the coil to produce the distortion-corrective forces.

(continued overleaf)

The magnet coil is placed over the workpiece to correct the distortion over one small area at a time. It is repositioned and pulsed as necessary until the distortions are removed from the entire surface of the workpiece.

Notes:

1. The special feature of this invention is the design of the magnet coil and mounting.
2. The electrical conductivity of the material being processed determines the effectiveness of electrical energy conversion to magnetic forces. The electromagnetic hammer cannot be used directly on nonconductive materials.
3. The coils can be made small and light and connected to a remote power supply by means of long transmission lines to provide an assembly-line tool for removing distortions from sheet-metal components.
4. The electromagnetic hammer should be advantageous in metalworking operations requiring the controlled application of a load on a small area of workpiece at any one time.
5. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B65-10342

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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